PROCESS FOR UPDATING MAP DATA AND NAVIGATION SYSTEM

10/506314

BACKGROUND OF THE INVENTION

FIELD OF INVENTION

[0002] The invention concerns a process for updating positional data. It further concerns a navigation system according to the precharacterizing portion of Claim 5.

Related Art of the Invention

[0003] One such navigation system with a digital map of a road and path network and a digital supplemental map is described in EP 0 330 787 B2. The digital map is stored on a CD. The digital supplemental map includes local or theme type data to supplement the digital map, and is brought into the vehicle by a portable storage medium and/or wireless means. For navigational guidance, both the digital map as well as the digital supplemental map are used. To use the digital map and the digital supplemental map for navigational guidance, differential data is produced, which describes the changes in the digital supplemental map relative to the digital map. The digital map on CD is static. Changes and updates of the data of the road and path network is carried out by an updating of the digital supplemental map.

SUMMARY OF THE INVENTION

[0004] It is the task of the invention to provide a process which makes it possible to update the digital map of a road and path network in the vehicle. Further, a navigation system particularly suitable for carrying out the process is to be provided.

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[0005] This task is solved, with regard to the process, by the characterizing features of Claim 1 and, for the navigation system, by the characterizing features of Claim 5. The dependent claims concern advantageous developments and further advancements of the invention.

[0006] The invention is based upon the idea that, in the importing of updates for the digital map of a road and path network in a navigation system, the digital supplemental map is likewise updated using differential data. The digital map of the road and path network is usually stored statically on a data carrier and is updated by introducing a new data carrier with a thereupon stored updated digital map into the navigation system. The digital map is supplemented with data from a digital supplemental map, which stores individual locationally relevant attributes of the road and path network of the digital map. The locally relevant attributes are based on elements of the road and path network stored in the digital map. The elements of the road and path network stored in the digital map include, for example, edges and/or bends and/or other elements. The attributes stored in the digital updating map can be changed for example by the driver and/or by data transmitted by a geographically fixed center and/or automatically by the vehicle system. If the digital map changes, upon which the attributes stored in the supplemental map are based, then, among other things, the data of the supplemental map is no longer suited for use. This can be the case for example when an edge and/or a bend and/or other elements, upon which an attribute is based or indexed, becomes omitted in the updated version of the digital map, or if an identifier of the edge and/or the bend and/or the other elements has changed. In that case, the attributes of the

supplemental map can no longer be correlated with the elements of the digital map.

[0007] For updating the digital map, differential data is established in step a) of the process, which produces the differences between the updated digital map and the digital map previously employed in the vehicle. The differential data can be established for example by the producer of the digital map and the updated digital map. In a preferred embodiment of the invention, the differential data is transmitted or provided to the client, the vehicle user, along with the updated digital map. The differential data are then imported into the vehicle by the same way as the updated digital map, for example, via a portable storage medium such as, for example, a CD-ROM and/or a flashcard and/or a DVD. The differential data can also be transmitted from a geographically fixed center. The generating of the differential data can alternatively or additionally occur for example in a geographically fixed center, to which the data of the digital map and the updated digital map are transmitted by the map manufacturer. The transmission of the differential data into a vehicle can occur wireless from the geographically fixed center, for example via a mobile radio network or a broadcast medium such as for example DAB (digital audio broadcast) and/or DVB (digital video broadcast). The transmission of the differential data into the vehicle can also occur by wire from the geographically fixed center, for example via a network and/or a data transmission line in a repair facility and/or a service station.

[0008] In step b) of the process the digital map in the vehicle is replaced by the updated digital map. Thereby, the basis of

the elements can change, to which the attributes in the supplemental map are indexed.

[0009] By updating the supplemental map using the differential data in step c) of the process, the supplemental map is converted, so that the resulting updated supplemental map can be employed in combination with the updated digital map. Thus, in the differential data, for example those identifiers used in the updated digital map which have changed with regard to the identifiers used in the previous digital map are stored or recorded. There can also be recorded in the differential data those identifiers that are not to be replaced by new identifiers, but rather are to be cancelled without substitution. The supplemental map can accordingly be updated by use of the differential data, so that the attributes of the supplemental map, following conversion, can again be clearly correlated again to meaningful recognition or identification of bends and/or edges and/or other elements of the digital map. Preferably, the conversion of the digital supplemental map into the updated digital supplemental map using the differential data occurs in the vehicle. This has the advantage, that only the relatively small data quantity of the differential data must be supplementally imported into the vehicle; the digital supplemental map, which is individually produced by the driver and/or for the vehicle, however, can remain in the vehicle and is immediately employable following the conversion.

[00010] The attributes stored in the digital supplemental map supplement the digital map with regard to local data or points of interest, for example, as tour guides for an area which is the navigational goal of the vehicle. The digital supplemental

map can however also contain information as attributes, which are necessary for the comfort functions of the navigation system, for example providing information with regard to particular attractions relevant to certain themes. The digital map can alternatively or additionally contain safety relevant information as attributes, for example, road curvature, angles of inclination, etc.

[00011] In the vehicle the data carrier with the digital map is checked for example by the navigation system, and it is determined whether the version of the digital map necessitates a conversion of the digital supplemental map. This checking can occur for example according to the process described in DE 100 37 397 A1 and/or a similar process. In the case that it is determined in the vehicle, for example by the navigation system, that an updating of the digital supplemental map is necessary, then a request is made for differential data for the updating the digital supplemental map.

[00012] The request for the differential data, in order to update the digital supplemental map, can occur preferably for example thereby, that the differential data are requested and read in from the inserted data carrier of the digital map. Preferably the requisitioning can also be comprised therein, that the driver is prompted by acoustic and/or optical output, to insert the portable data carrier with the differential data. If the data carrier with the differential data is introduced, then the navigation system carries out the conversion of the digital supplemental map. This embodiment of the invention has the advantage, that for updating of the digital supplemental map, no communication link need be established with the center, and thus

it is not associated with any communication costs. If no data carrier with differential data is present in the vehicle, then there is the possibility for the driver to request the differential data from the center and to have the differential data transmitted to him wirelessly. This embodiment of the invention has the advantage, that even when no differential data is present in the vehicle, the digital supplemental map can be updated without great expense for the driver.

[00013] In a further advantageous embodiment of the invention the requisitioning of the differential data occurs directly by a request to the center, from which the differential data is transmitted wirelessly. This has the advantage, that the driver need not be informed regarding the transpiration of the conversion, since it occurs completely automatically.

Brief Description of the Drawings

[00014] Preferred embodiments of the invention are described in the following on the basis of associated figures. There is shown respectively in schematic representation:

Fig. 1 a schematic representation of a process for updating map data of a digital supplemental map **22**,

Fig. 2 a schematic representation of a navigation system in a vehicle with digital map **12** and digital supplemental map **22**, and

Fig. 3 a schematic representation of a navigation system in a vehicle with updated digital map **14** and updated digital supplemental map **24**.

Detailed Description of the Invention

[00015] In the figures the same reference number is used for corresponding elements.

[00016] Fig. 1 schematically shows a process for updating map data of a navigation system. In the center **10** differential data **18** are produced in a computer **16** using a digital map **12** and an updated digital map **14**, which provide the differences between the digital map **12** and the updated digital map **14**. The updated digital map **14** is introduced into the vehicle **20** in a conventional manner, for example via a CD-ROM **15**. In the vehicle **20** the computer **26** of the navigation system recognizes that an update of the digital supplemental map **22** is necessary and transmits a request **19** to the center **10**. The center thereupon transmits the differential data **18** to the vehicle **20**. In the vehicle **20** then, using the differential data **18** and the digital supplemental map in the computer **26,** produces the updated supplemental map **24**.

[00017] The navigation system in vehicle **20** shown schematically in Fig. 2 includes the computer **26**, vehicle sensors **28**, a memory **30**, in which the digital map **12** and the digital supplemental map **22** are stored, an input/output unit **32** and a communication device **34** for wireless communication. The vehicle sensors **28** include, for example, devices for determining position, such as for example a GPS-receiver, magnetic field sensor, trip meter, rotation angle sensor, steering angle sensor. The input/output unit **32** makes possible user input such as for example via a keyboard, a touch sensitive display screen and/or a voice activated unit. The input/output unit **32** allows additional

outputs to the user in optical form, for example via a display unit, or in acoustic form, for example via speech output.

[00018] In Fig. 3 the navigation system is schematically shown following updating of the digital map **12** to the updated digital map **14** and the conversion of the digital supplemental map **22** to the updated digital supplemental map **24**.